

Appl. No. : 10/074,722
Filed : February 11, 2002

Information Disclosure Statement (IDS)

Applicants acknowledge receipt of initialed copies of the PTO-1449 forms submitted to the Office with the IDS submissions filed on April 8, 2003, and November 25, 2002. Applicants provide herewith a courtesy copy of the IDS and PTO-1449 forms submitted to the Office on August 27, 2002, and May 6, 2003, along with a copies of the return postcards received by Applicants showing that the Office received these IDS submissions on September 3, 2002 and May 9, 2003, respectively. Applicants respectfully request consideration of the references listed in these latter submissions, along with copies of the respective initialed PTO-1449 forms.

Claim Rejections - 35 U.S.C. §103(a)

Claims 1-47 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Murthy et al. (U.S. Patent No. 6,373,112), further in view of Nakabayashi et al. (U.S. Patent No. 6,319,782) and Shiota et al. (U.S. Patent No. 5,879,970). Applicants respectfully traverse these rejections.

Applicants respectfully submit that none of the cited references, each alone or in any combination, disclose or suggest the combinations of limitations recited in the instant claims. For the convenience of the Office, the rejections of Claims 1-47 are discussed below in sections corresponding to each of independent Claims 1, 20 and 33.

Claims 1-19 and 40-41

Independent Claim 1 is directed to a method of forming a transistor gate stack that involves forming a high dielectric constant material over a semiconductor substrate; depositing a silicon-containing seed layer over a high dielectric constant material under seed phase conditions selected to minimize hydrogen reduction of the high dielectric constant material; and depositing a silicon-containing bulk layer over the seed layer under bulk phase conditions different from the seed phase conditions, the bulk phase conditions selected to result in a higher deposition rate than the seed phase conditions. Applicants respectfully submit that the claimed invention, as defined by the recited combination of limitations, is neither taught nor suggested by the cited references. Likewise, dependent Claims 2-19 and 40-41 recite a number of additional limitations

Appl. No. : 10/074,722
Filed : February 11, 2002

that, in combination with the limitations set forth in the claims from which they depend, define additional inventions that are neither taught nor suggested by the cited references.

The Office states that Murthy discloses depositing a silicon-containing seed layer over a high dielectric constant material under seed phase conditions and then depositing a silicon-containing bulk layer over the seed layer under bulk conditions selected to result in a higher deposition rate than the seed phase conditions. However, the Office does not state that Murthy discloses seed phase conditions selected to minimize hydrogen reduction as recited in the claimed combinations. As explained in the specification at, e.g., paragraph [0077], minimizing hydrogen reduction during the deposition of the seed layer preferably includes minimizing hydrogen content in the process gases. Applicants note that Murthy specifically discloses the use of hydrogen as the carrier gas (see column 4, lines 52-55), without teaching or suggesting that such use should be minimized in order to minimize hydrogen reduction as recited in the claimed combinations.

The Office recognizes that Murthy does not teach or suggest minimizing hydrogen reduction in the claimed combinations, but states that Shiota discloses using a non-hydrogen carrier gas. However, the disclosure of Shiota would not motivate one skilled in the art to modify the seed phase of Murthy, while maintaining the bulk layer of Murthy unchanged. Likewise, the disclosure of Nakabayashi would not motivate one skilled in the art to modify Murthy in the manner indicated by the Office.

Applicants respectfully submit that the Office has not established a *prima facie* case of obviousness because there is no motivation to modify Murthy to meet the instant claims. See M.P.E.P. § 2143. Rather than establishing a motivation to combine, Shiota teaches away from the instantly claimed combinations of limitations. "It is improper to combine references where the references teach away from their combination." M.P.E.P. §2145(X)(D)(2).

Therefore, because a *prima facie* case of obviousness has not been established, Applicants respectfully request reconsideration and withdrawal of the rejection of Claims 1-19 and 40-41 under 35 U.S.C. §103(a) as being unpatentable over Murthy, further in view of Nakabayashi and Shiota.

Appl. No. : 10/074,722
Filed : February 11, 2002

Claims 20-32 and 42-44

Claim 20 is directed to a method of forming a structure in an integrated circuit that involves forming a layer of high dielectric constant material and depositing an electrode material over the layer of high dielectric constant material by flowing a higher order silane. Applicants respectfully submit that the claimed invention, as defined by the recited combination of limitations, is neither taught nor suggested by the cited references. Likewise, dependent Claims 21-32 and 42-44 recite a number of additional limitations that, in combination with the limitations set forth in the claims from which they depend, define additional inventions that are neither taught nor suggested by the cited references.

The Office states that Murthy discloses depositing a silicon-containing seed layer over a high dielectric constant material. Applicants note that Murthy specifically refers to the use of silane to deposit the seed layer, not a higher order silane. The Office recognizes that Murthy does not teach or suggest the use of a higher order silane, but points to such disclosure in Nakabayashi. However, Applicants respectfully submit that the Office has not pointed to a teaching or suggestion to modify the process of Murthy to replace the disclosed silane in Murthy's process with a higher order silane. One skilled in the art would not be motivated to make such a replacement because Nakabayashi discloses that the use of disilane results in the "undesirable" formation of amorphous silicon oxide, *see* Nakabayashi at column 6, lines 61-64; column 7, lines 13-16; column 8, lines 53-56; column 9, lines 6-9; etc. Nakabayashi discloses the use of chlorine to remove the undesired oxide, but one skilled in the art would likely view such use as adding undesired complexity and cost to the process of Murthy, in the absence of a particular suggestion to modify Murthy. Nor does Shiota provide a motivation to modify Murthy in the manner suggested by the Office.

Applicants respectfully submit that the Office has not established a *prima facie* case of obviousness because there is no motivation to modify Murthy to meet the instant claims. *See* M.P.E.P. § 2143. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection of Claims 20-32 and 42-44 under 35 U.S.C. §103(a) as being unpatentable over Murthy, further in view of Nakabayashi and Shiota.

Appl. No. : 10/074,722
Filed : February 11, 2002

Claims 33-39 and 45-47

Claim 33 is directed to a method of forming a silicon-containing material over a high dielectric constant material that involves loading a substrate into a single-substrate reaction chamber and depositing a silicon-containing layer over a high dielectric constant layer on the substrate without flowing hydrogen. Applicants respectfully submit that the claimed invention, as defined by the recited combination of limitations, is neither taught nor suggested by the cited references. Likewise, dependent Claims 34-39 and 45-47 recite a number of additional limitations that, in combination with the limitations set forth in the claims from which they depend, define additional inventions that are neither taught nor suggested by the cited references.

As discussed above, Murthy specifically discloses the use of hydrogen as the carrier gas (see column 4, lines 52-56) and thus fails to teach or suggest the instantly recited "without flowing hydrogen" limitation in combination with the other recited limitations. Nakabayashi fails to teach or suggest excluding hydrogen from Murthy's process in the manner recited in the claimed combinations, and Shiota teaches away from such exclusion, as discussed above.

Applicants respectfully submit that the Office has not established a *prima facie* case of obviousness because there is no motivation to modify Murthy to meet the instant claims. See M.P.E.P. § 2143. Therefore, Applicants respectfully request reconsideration and withdrawal of the rejection of Claims 33-39 and 45-47 under 35 U.S.C. §103(a) as being unpatentable over Murthy, further in view of Nakabayashi and Shiota.

Conclusion

Applicants respectfully submit that the instant application is in condition for allowance, early notification of which would be appreciated. Should the Office disagree, Applicants respectfully request a telephonic interview to discuss any outstanding issues. The Office is respectfully invited to contact Applicants' representative at the telephone number provided below in this regard.

This response is intended to be fully responsive to the aforementioned Office Action. However, if some matter or compliance with some requirement has been inadvertently omitted, Applicants respectfully request that they be given a new time period for reply under 37 C.F.R. §1.134 to supply the omission. See M.P.E.P. §714.03.